1. A multiple source array for illuminating an object, the multiple source array comprising:

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a reflective mask having an array of spatially separated apertures;

at least one optic positioned relative to the mask to form an optical cavity with the mask; and

a source providing electromagnetic radiation to the optical cavity to resonantly excite a mode supported by the optical cavity, wherein during operation a portion of the electromagnetic radiation built-up in the cavity leaks through the mask apertures towards the object.

2. The multiple source array of claim 1, wherein the excited mode has transverse dimensions at the reflective mask that are substantially larger than a transverse dimension of each aperture.

3. The multiple source array of claim 2, wherein the transverse dimensions of the excited mode at the reflective mask are more than 50 times larger than the transverse dimension of each aperture.

4. The multiple source array of claim 1, wherein each aperture has a transverse dimension smaller than the vacuum wavelength of the electromagnetic radiation provided by the source.

5. The multiple source array of claim 1, wherein each aperture has a transverse dimension comparable to the vacuum wavelength of the electromagnetic radiation provided by the source.

6. The multiple source array of claim 1, wherein the apertures are formed by holes in the reflective mask.

7. The multiple source array of claim 1, wherein the apertures are formed by dielectric regions in the reflective mask.

8. The multiple source array of claim 1, wherein each aperture comprises a dielectric region defining a waveguide having transverse dimensions sufficient to support a propagating mode of the electromagnetic radiation, wherein during operation the waveguides couple the electromagnetic energy built-up in the cavity between opposite sides of the mask.

9. The multiple source array of claim 8, wherein the reflective mask further comprises an end mask portion adjacent the object, and wherein each aperture further comprises a secondary aperture formed in the end mask portion and aligned with the corresponding waveguide, wherein each secondary aperture has a transverse dimension smaller than the transverse dimensions of the corresponding waveguide.

10. The multiple source array of claim 9, wherein the transverse dimension of each secondary aperture is smaller than the vacuum wavelength of the electromagnetic radiation provided by the source.

11. The multiple source array of claim 9, wherein the reflective mask comprises a reflective dielectric stack surrounding the waveguides, and wherein the end mask portion comprises a metal layer.

12. The multiple source array of claim 8, wherein each waveguide defines a second optical cavity between the opposite sides of the mask, and wherein the length of each waveguide is selected to be resonant with the corresponding propagating mode of the electromagnetic radiation.

13. The multiple source array of claim 1, wherein the reflective mask comprises a reflective dielectric stack.

14. The multiple source array of claim 13, wherein the reflective dielectric stack is adjacent the optical cavity and the reflective mask further comprises an antireflection coating adjacent the object.

15. The multiple source array of claim 1, further comprising a dielectric material contacting the mask in the cavity.

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16. The multiple source array of claim 15, wherein the dielectric material is an Amici lens.

17. The multiple source array of claim 15, wherein the optical cavity is a linear optical cavity.

18. The multiple source array of claim 17, wherein the at least one optic comprises one optic and the linear optical cavity is formed by two surfaces, the first surface being defined by the optic and the second surface being defined by the interface between the reflective mask and dielectric material.

19. The multiple source array of claim 18, wherein the dielectric material fills the space between the two surfaces and the first surface is defined by the interface between the optic and the dielectric material.

20. The multiple source array of claim 19, wherein the optic is a lens.

21. The multiple source array of claim 1, wherein the at least one optic comprises two optics and the cavity is a folded cavity formed by three surfaces, the first surface being defined by the first optic, the second surface being defined by the second optic, and the third surface being defined by the interface between the reflective mask and dielectric material.

22. The multiple source array of claim 21, wherein the first and second surfaces define the end surfaces for the folded optical cavity.

23. The multiple source array of claim 1, wherein the optical cavity is a ring cavity.

24. The multiple source array of claim 23, wherein the at least one optic comprises two optics and the ring cavity is formed by three surfaces, the first surface being defined by the first optic, the second surface being defined by the second optic, and the third surface being defined by the interface between the reflective mask and dielectric material.

25. The multiple source array of claim 1, further comprising an active feedback system for maintaining the resonance between the optical cavity and the electromagnetic radiation provided by the source.

26. The multiple source array of claim 25, wherein the active feedback system comprises an electronic controller that causes the source to change the wavelength of the electromagnetic radiation in response to a servo signal derived from a portion of the electromagnetic radiation reflected from the optical cavity.

27. The multiple source array of claim 25, further comprising a dielectric material at least partially filling the optical cavity, and wherein the active feedback system comprises a temperature controller coupled to the dielectric material and an electronic controller that causes the temperature controller to change the temperature of the dielectric material in response to a servo signal derived from a portion of the electromagnetic radiation reflected from the optical cavity.

28. The multiple source array of claim 25, wherein the active feedback system comprises a transducer coupled to one of the optics that form the optical cavity and an electronic controller that causes the transducer to dither the coupled optic in response to a

servo signal derived from a portion of the electromagnetic radiation reflected from the optical cavity.

29. The microscopy system of claim 1, wherein the at least one optic positioned relative to the mask forms a stable optical cavity with the mask.

30. A microscopy system for imaging an object, the microscopy system comprising:

the multiple source array of claim 1,

a multi-element photo-detector; and

an imaging system positioned to direct a return beam to the multi-element detector, wherein the return beam comprises electromagnetic radiation leaked to the object and scattered/reflected back through the apertures.

31. The microscopy system of claim 30, further comprising a pinhole array positioned adjacent the photo-detector, wherein each pinhole is aligned with a separate set of one or more detector elements, and wherein the imaging system produces a conjugate image of each aperture on a corresponding pinhole of the pinhole array.

32. The microscopy system of claim 30, further comprising:

an interferometer which separates the electromagnetic radiation from the source into a measurement beam which is directed to the optical cavity and a reference beam which is directed along a reference beam path and combined with the return beam to interfere at the multi-element photo-detector.

33. A microscopy system for imaging an object, the microscopy system comprising:

the multiple source array of claim 1,

a multiple detector array comprising an array of spatially separated apertures;

a multi-element photo-detector; and

an imaging system positioned to direct a signal beam to the multi-element detector, wherein the signal beam comprises electromagnetic radiation leaked to the object and transmitted by the object through the apertures of the detector array.

34. A microscopy system of claim 33, wherein the apertures of the source array are aligned with the apertures of the detector array.

35. The microscopy system of claim 33, further comprising a pinhole array positioned adjacent the photo-detector, wherein each pinhole is aligned with a separate set of one or more detector elements, and wherein the imaging system produces a conjugate image of each aperture of the detector array on a corresponding pinhole of the pinhole array.

36. The microscopy system of claim 33, further comprising:

an interferometer which separates the electromagnetic radiation from the source into a measurement beam which is directed to the optical cavity and a reference beam which is directed along a reference beam path and combined with the signal beam to interfere at the multi-element photo-detector.

37. A source for illuminating an object, the source comprising:

a reflective mask having at least one aperture; and

at least one optic positioned relative to the mask to form a stable optical cavity with the mask, wherein during operation a portion of electromagnetic energy built-up in the cavity couples through the mask aperture towards the object.

38. A method for illuminating an object with multiple sources, the method comprising:

resonantly exciting a mode of a stable optical cavity; and

coupling electromagnetic radiation out of the optical cavity towards the object through an array of apertures in one of the optics that define the cavity, wherein

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transverse dimensions of the excited mode are substantially larger than a transverse dimension of each aperture.